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CURRENT NOTES ON ANTHROPOLOGY (IV.)

THE SIGNIFICANCE OF VARIATIONS IN THE HUMAN SKELETON.

It is a little odd that two papers on the same subject, with almost the same title, prepared independently at the same time, should agree in defending a new view of the significance of variations and anomalies in organic forms.

The one of these is that which I read before the American Association for the Advancement of Science in August last, published in the *American Anthropologist* for October, entitled *Variations of the Human Skeleton and their Causes*; the other was the Shattuck Lecture, delivered before the Massachusetts Medical Society by Dr. Thomas Dwight, Professor of Anatomy at Harvard University, with the title, *the Range and Significance of Variation in the Human Skeleton*.

The two papers, although drawing their material from wholly independent sources, and reasoning along different lines, reach quite the same conclusion, to wit: That variations, which in the human skeleton resemble forms in lower animals, are not to be interpreted as 'reversions' or 'atavistic retrogressions,' but that other laws should be invoked to account for them, such as nutrition, mechanical action, etc.

Dr. Dwight adds the following significant words: "The opinion is growing daily stronger among serious scholars that if man's body came from a lower form it was not by a long process of minute modifications, but by some sudden, or comparatively sudden transition."

This is the opinion which, under the name *heterogenesis*, I have defended for many years (see my *Races and Peoples*, pp. 80, 81). It has lately received strong support from some of Bateson's admirable studies in variation.

THE ANTIQUITY OF MESOPOTAMIAN CULTURE.

At a recent meeting of the Oriental Club of Philadelphia, Dr. J. P. Peters, whose researches among the ruins of the valley of the Euphrates are well known, mentioned his observations on the deposition of alluvium by the river as a chronometer for measuring the antiquity of some ruin-mounds. The deposits from the known date of Alexander's conquests display marked uniformity; and taking the depths of these as a standard, the foundations of Ur (the 'Ur of the Chaldees' of Genesis, the modern Muchair) and of Eri-chu (the modern Abu-Shahreïn) must have been laid about seven thousand years B. C.

This venerable antiquity, however, appears quite modern compared to that assigned the same culture in some calculations laid before the Académie des Inscriptions by M. Oppert last summer. They had reference to the established beginnings of the Sothiac cycle and the Chaldean Saros, or recurrent cycles of eclipses. His argument was that the former dated from an observation of the cosmical rising of Sirius visible to the naked eye. This could occur only at an eclipse of the sun at its rising; and this he figured was upon a Thursday, August 29, in the year 11,542 before Christ! And as it was visible only south of latitude 26° , the locality of the observation he fixes for various reasons at the island of Tylos, the modern Bahrein, in the Persian Gulf. Truly, this is a *tour de maître* in archæology which makes one dizzy!

DIVISIONS OF THE STONE AGE.

A USEFUL broadside, about twenty inches square, presenting succinctly the subdivisions of the Stone Age, was published last year by M. Philippe Salmon in the *Bulletin de la Société Dauphinoise d'Archæologie et d'Ethnologie*. The three periods it presents are the palæolithic, the mesolithic and the neolithic. These are subdivided into epochs, six in all, each characterized by the products

of definite stations, peculiar industries, climate and fauna. As a synopsis of the accepted data, from the best French authorities, the scheme merits high praise.

The position of the mesolithic division takes the place of the 'hiatus,' which figures in the works of Mortillet and others as an unexplained time of transition between the rough and polished stone ages. Salmon, however, claims that no such gap exists. He quotes, for instance, the station of Campigny, near the lower Seine, and Spiennes, in Belgium, as proofs that the peoples and the culture of the earlier and ruder epochs progressed steadily, without important breaks, up to the full bloom of the neolithic generations. The importance of such a generalization, if it could be established, would be great; for, working back from historic to pre-historic times, there is no doubt but that the neolithic nations of central and western Europe were of Aryan speech, and Salmon's argument would carry this mighty stock in lineal line to the pre-glacial fishermen in the valley of the Somme.

THE TEACHING OF ANTHROPOLOGY.

In a little pamphlet which I published in 1892, entitled 'Anthropology as a Science and as a Branch of University Education,' a plan was suggested by which this science could be introduced into our universities as one of the optional branches for the doctorate of philosophy, and its importance as a department of the higher education was emphasized.

The subject has been taken up lately in Germany with gratifying interest. In the 'Globus' for October, 1894, Professor Friedrich Müller, of Vienna, warmly advocates that a chair representing anthropology should be recognized as a proper addition to the faculty of a great university; and a few weeks later, in the same journal, the question was discussed by Dr. Rudolf Martin, of the University of Zurich. The

latter agrees that anthropology properly takes its place in the faculty of philosophy; but his division of the science is open to doubt. He would class all its branches under two groups: those relating to, 1. physical anthropology; and, 2. psychical anthropology, or 'ethnology.' Under the latter, he includes pre-historic archæology; and not seeing very clearly where in such a scheme ethnography would come in, he takes the short cut of leaving it out altogether! This is a serious omission, as in many respects descriptive racial and tribal anthropology alone offers the indispensable raw material on which to build up a true science of man. His opinion, that at least two instructors, one for the physical and one for the psychical side, are desirable, will, of course, commend itself; but each should at the same time be well versed in the side which he does *not* teach.

GUATEMALAN ANTIQUITIES.

UNDER the sensational title 'An American Herculeum,' a writer, M. X. West, in '*La Nature*,' November 3, describes the site of an ancient city, three kilometers from Santiago Amatitlan, Guatemala. His story is that at a depth of five or six meters, under a mass of volcanic cinders and tufa thrown out by some sudden eruption, there have recently been discovered the remains of a village with all the appurtenances of its daily life, finely decorated pottery, stone implements and images, the foundations of its buildings, and blocks bearing inscriptions in unknown characters. More astonishing is the statement that along with these were cups of graceful shape of glass, sometimes colored. This casts serious doubt on the whole narrative, unless 'volcanic glass,' *i. e.*, obsidian, is intended, as nowhere on the American continent had glass-making been discovered by the natives; and, indeed, it is very doubtful if at any point they had reached the art of glazing pottery.

At the Madrid Exposition, in 1892, the Lake of Amatitlan figured as the locality where an extraordinary seal, Egyptian in appearance, and some other probable frauds were found. No doubt it was the center of a high native culture, that of the Zutuhils, a Mayan tribe; and there seems to be also some modern adepts at present in the vicinity, whose skill should admonish the collector to be wary in investing in articles of that *provenance*.

AN EXCELLENT INTRODUCTION TO ANTHROPOGEOGRAPHY.

THE various relations which his geographical surroundings bear to man in his personal, social and national life constitute the almost new science of 'anthropo-geography,' to which Professor Ratzel, of Leipzig, has lately contributed a standard work. In this country it has received little attention from educators since the time of Professor Guyot, whose 'Earth and Man' was creditable for its period. The more modern opinions and results have been admirably summed up in a little volume written by Professor Spencer Trotter, of Swarthmore College, under the title 'Lessons in the New Geography' (Boston, D. C. Heath and Co., 1895). In the compass of 182 pages the author presents, in succinct language, suitable to the student and the general reader, the relations which have existed between the distribution of land and water, the climates of the various zones and the plants and animals which they produce, to the life and development of the human species. He then proceeds to define the recognized types or races of men, and to point out their distribution when they first became known. The book closes with observations on commerce and the progress of discovery, and various tables of statistical information.

Whether as a text-book in schools and colleges, or as a trustworthy and lucid exposi-

tion of the subject for general reading, this volume merits cordial commendation, and should awaken a wider interest in the attractive topics which it discusses.

THE OROTCHE TARTARS.

AN entertaining description of this tribe is given from Russian sources in the 'Journal of the China Branch of the Royal Asiatic Society,' Vol. XXVI. (Shanghai, 1894). It is a member of the Tungusic stock, and is situate along the eastern coast of the continent, from 42° to 52°; but the pure types are found only toward the northern limit. They are small in stature, a man five feet four inches in height being considered tall. The women average six inches shorter than the men. Their bodies are thick set and muscular, and their power of endurance remarkable. Like all the other pure blood tribes in Eastern Siberia, they are steadily diminishing, either through intermixture of blood or through new diseases introduced by foreigners.

Their boats are rude, but they manage them skillfully, which is the more necessary, as none of them knows how to swim, and when a craft capsizes its occupants infallibly drown. This ignorance is owing to two causes: the coldness of the water at most seasons, and their invincible repugnance to cleanliness. They are adepts in making garments of the bowels and skins of fishes, from which they are sometimes called 'the fish-skin Tartars.' They are also handy with tools.

Their religion is ostensibly that of the orthodox Greek Church; but really their ancestral Shamanism is as strong as ever. The residences of the Shamans are denoted by sticks or poles planted in front of them, carved to resemble animals, like the Totem poles of the north-west coast. Their chief divinities make a triad, being Boa Anduri, 'spirit of the sky;' Temu Anduri, 'spirit of the sea,' and Kamtchanga Anduri, 'spirit

of the mountains.' They indulge in violent religious frenzies, in which they speak in unknown tongues. One woman was unable to talk in her own for two months after such a spell.

THE FUTURE OF THE COLORED RACE IN THE UNITED STATES.

THIS momentous question has been made the subject of careful investigation by a physician of Savannah, Dr. Eugene R. Corson. His essay is published in the 'Wilder Quarter-Century Book,' a well deserved memento issued by the pupils of Dr. Burt C. Wilder, of Cornell University, at the expiration of his first quarter century of teaching.

Dr. Corson regards the relative mortality of the two races, white and colored, in the United States as 'the pith of the whole matter;' and, therefore, addresses his special attention to this. From his own observations and the census statistics, he concludes that the pure blacks have in our country a decidedly higher mortality than the whites; more die in childbirth, they are more susceptible to disease, they succumb more quickly, they are prone to bacillar diseases in a higher degree, and their alleged exemption from malaria is not generally true. The hybrids between the two races he pronounces less fertile and less viable than either. "Miscegenation is a reducing agent, chemically speaking."

From these considerations, which he advances, backed by large testimony, he reaches the comforting conclusion that there will be no 'war of races' among us; that the blacks will gradually fade out or become absorbed in the white population; and this in such a manner as not to deteriorate it.

THE PRE-HISTORIC TRIBES OF THE EASTERN UNITED STATES.

IN THE *Archiv für Anthropologie*, for November, 1894, Dr. Emil Schmidt undertakes to gather together the fragmentary facts which

cast light on the population of the Mississippi Valley and Atlantic slope of the United States at a date anterior to that of the tribes found there resident by the first explorers. He presents the question temperately and free from the fantastic notions which one generally anticipates in this investigation. His results may be briefly stated.

Beginning with the 'mound builders,' he points out numerous reasons for considering them the immediate ancestors of the present Indians; going further into their identification, he decides that the ancestors of the Cherokees were the mound builders of the Ohio Valley. The original seat of the Huron-Iroquois family he locates north of the Great Lakes, and that of the Algonquian family somewhere to the south of Hudson's Bay, where the Crees are still found speaking a pure and ancient dialect. These two mighty stocks moved slowly southward, driving the mound builders from the Ohio, and penetrating into Virginia. There they met the Dakotas, whom they destroyed, except the small tribes of the Tuteloes and Catawbias. The Gulf States were peopled by the Muskogean tribes from the south-west. The debated question whether there was a 'rough stone' or palæolithic age in the United States, he answers, from the evidence before him, in the negative.

GALTON'S METHOD OF ISOGENS.

MR. GALTON is fertile in the application of new methods to anthropologic data. In a recent article in the *Journal of Statistics* he applies the method in use among meteorologists to define lines of equal barometric pressure, to data of natality. His so-called 'isogens' are analogous to the *isobars* of the weather maps. They are lines of equal birth-rate forming a constant derived from the two variables, the age of the father and that of the mother.

By this ingenious and simple process he reaches some curious results. One is the unexpected law of natality, "That the sums of the ages of the parents are constant; in other words, that the birth-rate is determined by the joint ages of the father and mother. The difference between the ages of the two parents is of no account whatever in nine-tenths of the total number of marriages." Only in the obvious case where the wife is older than the husband and is approaching the limit of the child-bearing age, is this law at fault. Another odd fact developed by this method is that a woman approaching somewhat closely the limit of the child-bearing age, say about thirty-five or thirty-eight, is more fertile with a man of her own age than with one who is younger; though it is admitted certain social reasons may help to this result.

Like all of Mr. Galton's articles, this one will be found admirably presented and well worth study.

D. G. BRINTON.

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CURRENT NOTES ON PHYSIOGRAPHY (II.).

SIXTH INTERNATIONAL GEOGRAPHICAL CONGRESS.

THE Sixth International Geographical Congress is to be held in London from July 26th to August 3d, 1895, under the auspices of the Royal Geographical Society. An invitation circular has lately been issued, stating the general plan of the Congress, the conditions under which tickets of membership can be obtained, the program of subjects for discussion, and a most comprehensive list of honorary officers, honorary general committeemen, and committees in charge of various divisions of the subject proposed for discussion. An extended exhibit of geographical materials will be held in connection with the Congress, which altogether promises to be a most attractive reunion. The invitation circular can be

had from the Secretary, Royal Geographical Society, 1 Saville Row, London, W. A representative American attendance is highly desirable.

NATIONAL GEOGRAPHIC MONOGRAPHS.

A RECENT number of the 'National Geographical Magazine,' as well as a circular distributed by the American Book Co., New York, announces the early preparation of a series of geographical essays under the above title, prepared by various experts and addressed particularly to the public school teachers of this country. The intention of this series of monographs is to present accurate and properly correlated information upon the geography of our country, in simple, untechnical language, and with good illustrations, in such form that it may be practically useful in supplementing the ordinary teaching of physical geography. They are to help supply the teacher with that background of knowledge that is so essential to good teaching. They will not replace any existing text-books, but in time, as the number of monographs increases, they will certainly be freely drawn on by text-book makers. They deserve prominent mention in *SCIENCE*, for although reduced to as simple form as possible, the names of the authors announced are a guarantee that the monographs will be essentially scientific in character. Their appearance will be watched for with interest.

GEOGRAPHICAL PRIZES.

THE National Geographic Society announces as a subject for a competitive prize essay in 1895: 'The River Systems of the United States.' The essays must not exceed two thousand words in length, and will be received only from those public schools whose intention to compete is announced not later than May, 1895. The essays must be composed entirely by scholars. They must be written by the end of the

school year, 1894-'95, and submitted to the Society not later than July 15th next. The geographical gold medal of the Society will be awarded to the best essayist of the country; the second best will receive a certificate of honorable mention. The best essayist of each State will receive a certificate of proficiency from the committee on awards. This committee consists of General A. W. Greely, Professor T. H. Mendenhall and Superintendent W. B. Powell. Further information concerning the competition may be had from the Society by addressing its Secretary in Washington, D. C.

NEWELL'S REPORT ON AGRICULTURE BY IRRIGATION.

MUCH physiographic material is gathered in the harvest fields of other subjects. A good opportunity for physiographic gleanings is Newell's 'Report on agriculture by irrigation in the western part of the United States at the eleventh census' (1890), recently issued. In California, where irrigation has attained greater importance than in any other State, the advantageous arrangement of the canals and ditches is in many cases peculiarly dependent on the aggraded alluvial fans that the streams from the Sierra have so often built out from their canyons on emerging upon the open valley plain. The fans of Kings and Kern rivers are the best illustrations given of this kind. The abrupt slopes of the San Bernardino mountains in the southern part of the State are cut by deep narrow valleys from which the waste is strewn in great alluvial fans of unusual height and radius. Newell shows these to be of much importance in their relation to agriculture, but, as if to illustrate the backward condition of geographical terminology, and the slow penetration that the few terms already invented make among practical engineers, he calls these well-formed fans by the vague term, 'great masses.' "The debris, con-

sisting of sand, gravel and bowlders, has been piled in great masses at the points where the streams enter upon the lower plains." If it were not for the earlier account of these huge fans by Hilgard (*Bull. Geol. Soc. Amer.*, iii, 1891, 124) they could hardly be recognized here. In Arizona we read that the irrigating streams are largely supplied by rains induced by the enforced ascent of the winds when they encounter the precipitous and ragged fault scarp, where the great plateaus rise out of the lower desert plains. In Idaho a great expanse of dissected country, where the rivers have cut down deep valleys, cannot be irrigated without expensive engineering operations; but farther up the Snake River, "where the streams have not yet succeeded in cutting through the lava," the river water can be distributed over the plain with comparative ease. 'Yet' is a most expressive word for the geographer. The whole report is full of suggestive examples for extract and quotation.

BAYS AND FIORDS REGARDED AS SUBMERGED VALLEYS.

EARLY writers generally ascribed bays and fiords to the destructive action of the sea, or to local dislocation. Esmark, about 1826, was perhaps the first to ascribe much importance to ice as an agent in making the Norwegian fiords; a suggestion that was afterward carried to an extravagant extreme. Dana, on returning from the Wilkes expedition, introduced the idea that fiords are drowned valleys; but whether the erosion of the valleys was done by 'river work alone, or more or less by glaciers,' must be determined by local study. In the present view of the problem, glacial erosion is almost by general consent reduced to a moderate measure; it is chiefly the fiord basins that are now attributed to ice action, while fiord valleys are regarded by nearly all observers as of preglacial origin as ordi-

nary land valleys, afterwards submerged. Bays, like Chesapeake and Narragansett, are commonly regarded as resulting from the submergence of wide river valleys, modified by glacial erosion or deposition, if in glaciated regions. This modern view is lately reënforced in an article by Professor Shaler (*Evidences as to change of sea level*, *Bull. Geol. Soc. Amer.*, vi., 1885, 141-166), in which various reëntants of our coast, such as Chesapeake and Narragansett bays, the fiords of Maine, and the numerous depressions which break the northern part of the continent into a group of islands, are all ascribed wholly or chiefly to the submergence of stream-worn lands. The general problem of submergence seems, however, hardly so simple as 'to indicate a progressive subsidence of a somewhat uniform nature' along the Atlantic coast from Mexico to near the pole. The possibility of numerous subordinate and discordant oscillations in different parts of the coast is wide open; and while in a general way it may be said that our eastern coast has been depressed, it does not follow that the depression was synchronous throughout, as it must have been if its cause were a movement of the sea floor; hence a preference for this 'hypothesis of Strabo' hardly seems warranted. The submergence of our southern coast may now be going on, while the northern coast may be at present rising, but not risen enough to correct an earlier and greater submergence. This would make diverse continental movements the essential cause, and displacement of the sea floor only secondary.

GEOLOGIC ATLAS OF THE UNITED STATES.

ALTHOUGH primarily of geological interest, the several folios of this great atlas now issued are important to geographers from the accurate and succinct accounts that they give of topographical features. The topographical sheets alone are very instructive; but their value is greatly increased when

accompanied by explanations that have been prepared by trained observers who have been all over the ground, examining the forms of the surface as the expressions of internal structures. From the sheets in eastern Tennessee we may learn of the two peneplains that there give local illustration of wide-spread Appalachian forms. On the Livingston sheet, Montana, there is a fine illustration of one of the many extinct lake basins now drained through a steep-walled gorge, in a way so characteristic of the northern Rocky Mountains. With the Placerville sheet, in the California Sierra, the text tells of the reduction of the mountain belt to gentle slopes before the eruption of the great Neocene lava flows by which many of the older valleys were broadly filled; and of the deep canyons cut by the displaced rivers since the mountain belt has been upheaved with a westward slant. The plan of liberal distribution of these folios ensures that they will reach a wide variety of readers. They will be welcomed by many workers: students, teachers and investigators; geographers, geologists and economists.

GEIKIE'S GREAT ICE AGE.

THE third edition of this important work has been lately issued (New York, Appleton, 1895). Although distinctly a geological treatise, not written from the geographical point of view, it contains numerous pages of physiographic interest, for many glacial deposits are so young as still to preserve essentially their constructional form; hence the account of moraines, drumlins, rock-basins, and so on, are of immediate geographical value. The general subject of glacial erosion is hardly treated with the fulness that the many discussions it has given rise to would warrant; and the explanation of rock-basins does scanty justice to the opinions of many Swiss geologists who look on ice action as a secondary process compared to a gentle warping of pre-

existent valleys. The extract from Wallace's paper, defending the glacial excavation of rock-basins, would imply that that author was not acquainted with the numerous lakes of dislocation in our western territory. For American readers the two chapters and the several maps by Chamberlin will prove attractive.

W. M. DAVIS.

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LABORATORY TEACHING OF LARGE CLASSES—ZOOLOGY.*

IF the large and increasing attendance at our summer schools, and the publication of many books and the reports made by those dealing in scientific apparatus, can be taken as an index, the amount of zoological teaching is very rapidly increasing, and the conduction of large classes is a problem of considerable importance.

A class of college students numbering twenty or twenty-five, and conducted by one officer, is a large class and, even with a favorably equipped laboratory, is quite as large as a single teacher should attempt to carry. Of course, if a certain number of assistants can be engaged, a larger number of students can be directed, though this is virtually the establishment of so many sub-classes.

One of the first conditions for successful zoological instruction is that of immediate environment. To crowd a score or more of katabolic youth into a small, miserably-lighted room, and compel them to breathe the fumes of stale alcohol for two or three hours, is to invite failure. Each student should have a table to himself where there is good light, and where he feels a certain amount of proprietorship. It should be so located that he is not tempted to carry on a clandestine parasitism, or even a symbiotic

* A paper read before the American Society of Naturalists at the Baltimore meeting, December 28, 1894.

existence with his neighbors. He should be provided with instruments, drawing and dissecting, that are his own, and these ought not to be handed down from class to class, broken and rusty and inheriting mutilations from a long line of ancestors. Each table should be provided with a drawer or locker in which towel, dissecting tray, books, notes, etc., can be safely kept, and any disposition towards untidiness should be censured.

I do not think that the best dissecting material obtainable is any too good for the college student. An advanced worker, or one of a small class, may perhaps profitably examine poorly prepared material, but nothing can more effectually dampen the enthusiasm of an instructor than to see a student *pour* from carapace to the dissecting dish the only too appropriately named 'soft-parts' of a crab or lobster. There is everywhere an abundance of good laboratory material, if the teacher will only exercise a little activity and foresight. With the numerous preserving fluids, and with alcohol free of duty, the student should have perfectly preserved material, unless living forms are available.

The compromise that is often made between the lecture and laboratory, by the mere exhibition of specimens or the passing of specimens from hand to hand during the lecture, is slipshod and dangerous. Such a display may come off once or twice a month, and if carefully conducted is of considerable value, but if occurring frequently there is bound to be a most unfortunate sameness in the style of presentation. The average student who has carefully dissected the cranium of the cat or sheep will take away with him a better understanding of the mammalian skull than he who has viewed acres of diagrams or handled, for a moment, the skulls of all the typical vertebrates.

In certain laboratories it is considered good form to prohibit, or at least to dis-

courage, the free consultation of books of reference by the laboratory student. Pictures and diagrams, illustrating the animals under discussion, are supposed to poison the adolescent mind and should only be kept in the inner recesses of the professor's study, where he may occasionally retreat for a few moments of silent communication, after having been floored by a poser from one of his students. In my opinion, the student should be given every possible aid; there should be books galore; charts and diagrams should be conspicuous upon the wall; and fine dissections, made possibly by advanced students, anatomical preparations and models should be freely displayed upon the reference table. Prof. Howes, in his admirably equipped laboratory in London, has placed upon a ledge, running nearly around the room, a series of most beautiful dissections. In America these are too often hidden away in cases, and I fail to understand why the best of such material is placed in our museums, ostensibly for the education of the public, but actually to the sacrifice of the interests of the student.

Speakers at earlier meetings of this Society have, I think, not over-estimated the educational value of drawing, but we should be very careful that the permission to diagrammatize is not interpreted as permission for free-hand carelessness. The drawings should be carefully prepared; outline, composite pictures of the material studied.

It is unfortunate that we must introduce the microscope into our large class of 'zoology students.' The question of first expense, for every student must have an instrument, is a serious one, and then there is the time lost in giving a course in optics. Here, however, a little forethought will prevent much waste of the precious time actually appropriated to zoölogy. It is well to have one or two extra instruments in reserve, to use in case of accident, and there should be an abundance of the material

studied. I feel that one should be cautious in appropriating large time to the process of killing, staining, and other matters of pure technique, and especial care should be taken lest the disease of 'microtome-mania' become epidemic. The microtome is an instrument for the advanced worker and the investigator, but it is no uncommon thing to see a student, yielding to the blandishments of the instrument, cutting sections by the yard, when a few questions will reveal shameful ignorance of the gross anatomy of the animal imbedded.

One is inclined to think that the enthusiasm of the student is the proper index of the work accomplished. But it is not, at least not always. The course in zoölogy should be a course in zoölogy, and the student, certainly of the elementary class, should not be allowed to take alluring short cuts to histology, embryology and advanced morphology. There is a vast amount of microscopical work that can and ought to be done in our large classes. At Brown University the work of an entire term is upon the cat. The material is easy to procure; the organs are large, and I think the time of fifty students well spent. A critical study of other vertebrates should use up the two remaining terms of the year. The turtle and the snake very fairly represent the reptilian phylum; the latter, aside from popular prejudice, is a most satisfactory animal for the laboratory. I think it is a mistake not to more generally provide Elasmobranch material for the college student. When skate and 'dog-fish' can be so readily procured and so easily preserved, every zoölogical laboratory should have an abundance.

And now let me mention a condition, and the one upon which success with large classes most directly depends, viz., order and system. Though the members of our class are not all free and equal, as Americans they must be treated as such. The work

of a certain day must be planned for the class as a whole, and not for individuals of the class. All students should have, at the beginning of the session, the same equipment, the same material, and matters of neatness should be enjoined upon all alike. The water in the dissecting trays must be frequently renewed, organic refuse must be disposed of, the tables must be kept dry, the instruments should not be allowed to soak in the bottom of the pan, or the pencil used as a probe. The table should not be smeared with blood, fat and alcohol. There should be a place for everything, and 'systematic zoölogy,' in the sense of order, should everywhere prevail. It is much easier for the student to become indifferent to the orderly side of zoölogy than it is for him to acquire respect for the cleanly.

A definite syllabus, placed upon the board, or laboratory outlines, one on each table, must be used. The latter can be prepared by the teacher and struck off with a cyclostyle or hectograph, and they are of immense help. The student knows what to do and when and how to do it. Extra paragraphs may be added for those who work more rapidly; though quality and not quantity should be the end.

The teacher, with his eye upon the whole class, must go from table to table, quizzing here and helping there. He must be ready to dissect mutilated specimens and reproduce lost parts instantaneously; and thankful is he, if not too frequently he is constrained to follow that motto placed by Professor Agassiz so conspicuously at Penikese: "Do not be afraid to say, I do not know."

I must beg your forbearance while I say a few words in regard to the large zoölogy classes in our secondary schools. It is my opinion that laboratory classes, conducted along the lines which we have just mentioned, are not at the present time to be too strongly urged for the common schools. There are very few teachers who have had

proper training for this kind of work, though the number is happily on the rapid increase. The 'hard parts' of the lower animals, starfish, urchins, molluscs, crustacea, insects, etc., offer ample opportunity for elementary zoölogical work, but it seems to be hardly advisable to largely recommend the dissecting of mammals by the average class, though I think the isolated parts, eye, bones of the ear, the tongue, heart, brain, etc., can be properly and very profitably used. Elaborate outfits of dissecting instruments are not here necessary, though one or two microscopes are desirable. In the secondary school there is a splendid opportunity for the cultivation of the observational powers, by comparing the external characters of animals; by observing habits; how the bird breathes; how it involuntarily grasps the branch; the adaptation of structure to use in the feet of waders, scratchers and singing birds; the structure of the scale and feathers, and claws; the pneumaticity of the bones; the preening of the feathers; the dull coloring of the female; the shapes and colors of eggs and any peculiar nesting habits. It is all wrong for a child to think that zoölogy can only be learned over a dissecting dish. The fundamental principles of biology, the theory of adaptation, protective coloring, protective and aggressive mimicry, distribution, degeneration, parasitism and development can all be illustrated to and understood by the school-child who has never held a scalpel.

The school-room already has its plants; it should also have its local collection. The children make most enthusiastic and active collectors. It is not necessary that the teacher should be qualified to give off-hand the sesquipedalian scientific name of each and every insect that is brought to the school. A far better goal is reached when the student is taught to recognize homologies, to place grasshoppers, katydids and crickets together, to have a separate apart-

ment for butterflies and moths, and another for beetles, etc. Perhaps certain students may be interested in the molluscan fauna of the neighborhood and others may choose to collect cocoons. (I recently read in one of the ubiquitous anti-vivisection papers that the lung of the pond-snail is provided with most beautiful rows of minute horny teeth. Early observations would not only correct such aberrations, but would secure a familiarity with natural phenomena which would give that philosophical training that is often so lamentably lacking in our educated classes.) The child is delighted with the movements of aquatic animals. Aquariums should be in every school. There are hundreds of animals to be collected in any pond or stream, and how easy is it to here find themes for written exercises and models for drawing!

The zoölogy of the secondary school should not be merely an isolated subject of study. It is not attractive to some, and knowledge cannot be forced upon unwilling minds; but it can be unconsciously absorbed in solution. Zoölogy then should enter into the reading, the writing, the spelling, the arithmetic; geography is stupid without it, and the history of human progress is but distribution with the consequent 'struggle for existence' and the 'survival of the fittest.'

HERMON C. BUMPUS.

BROWN UNIVERSITY.

NOTES ON THE BIOLOGY OF THE LOBSTER.*

Reproduction.—After hatching a brood in May, the female usually molts and afterwards extrudes a new batch of eggs. In

*This paper was read before the Society of Morphologists, Baltimore, December 28th.

The following observations are from part of a prolonged investigation of the habits and development of the lobster, undertaken for the U. S. Fish Commission. The detailed work, now ready to go to press, will be published in the Fish Commission's Bulletin. It will contain a full presentation and discussion of the habits and general life-history of the adult lob-

this case egg-laying follows close upon copulation. Sometimes a female is impregnated immediately after the old eggs are hatched and before the molt occurs. A second copulation is then necessary for the fertilization of the eggs. Occasionally the seminal receptacle of a lobster is found loaded with sperm a year before the eggs are due.

Laying of Eggs.—Much confusion has surrounded this subject because of the lack of continuous observation throughout the year. The facts seem to be as follows: The majority of lobsters capable of spawning lay eggs in July and August. About 20 to 25 % extrude their eggs at other times, it may be in the fall, winter or spring. During a period of seven consecutive months five traps were kept set in the harbor of Wood's Holl, Mass., December 1st, 1893, to June 30th, 1894, and visited daily. In all 168 egg-lobsters were taken; 44, or 25.6 % of the number, bore eggs which had been laid in the fall and winter.

I have tabulated 51 lobsters coming from different parts of the coast of Maine, having external eggs which had been laid out of the usual season of July and August. In one case at Matinicus Id., Maine, February 4th, the eggs had been extruded but a few hours, and the yolk was unsegmented. Another from York Id., Maine, November 15th, had eggs in a late state of segmentation of the yolk. Still another from Brimstone Id., Maine, January 27th, had eggs in the nauplius stage. At Wood's Holl, in 1889 to 1893, the recorded observations (over 300 in all) show that the greatest number of eggs are laid in the last two weeks of

ster, and the habits of the larvæ and young during their period of immaturity. The history of the larva and the structure and development of the reproductive organs will be fully described, and the development of the embryo will also be reviewed. The work is illustrated by 54 full-page plates, many of which are executed in colors or reproduced from photographs, and by 40 figures in the text.

July, the whole period lasting from June 16th to August 31st. Data from the Maine coast (129 observations) indicate that the greatest number spawn in the first two weeks of August.

The spawning period of lobsters in the extreme north is said to last from July 20th to August 20th in Newfoundland. July and August are the months commonly assigned for the spawning in Prince Edward Island.

Number of Eggs Laid and Law of Production.—In the course of the work of lobster-hatching at the Station of the United States Fish Commission at Wood's Holl, it becomes necessary to remove the eggs from a large number of lobsters. These are carefully measured and the number deduced by simple calculation. I have tabulated the number of eggs laid in 4,645 lobsters measuring from 8 to 19 inches. In examining the column of averages one is struck by the fact that a ten-inch lobster bears twice as many eggs as one eight inches long; that a twelve-inch lobster bears twice as many as one ten inches long. It is therefore suggested that in early years of sexual vigor there is a general law of fecundity which may be thus formulated; the number of eggs produced by female lobsters at each reproductive period varies in a geometrical series; while the lengths of lobsters producing these eggs vary in an arithmetical series. If such a law prevails we would have the following:

Series of lengths in inches:

(1)	(2)	(3)	(4)	(5)	(6)
8	: 10	: 12	: 14	: 16	: 18

Series of eggs:

5,000 : 10,000 : 20,000 : 40,000 : 80,000 : 160,000.

An examination of the table shows how closely the first four terms of this series are represented in nature, and that when the 14-16-inch limit is reached there is a decline in sexual activity. Yet the largest

number of eggs recorded for lobsters of this size show that there is a tendency to maintain this high standard of production even at an advanced stage of sexual life.

A graphic representation of the fecundity of the lobster tells more forcibly than words or figures can do how closely it conforms to the law just enunciated. The curve which we obtain is the wing of a parabola; the curve of fecundity is parabolic up to the fourth term, where the ratio of production is distinctly lessened. The largest female lobster, carrying the largest number of eggs, was obtained at No Man's Land, June 9th, 1894. It was sixteen inches long and carried one pound of eggs, estimated to contain 97,440. It is safe to assume that the average number of eggs laid by a lobster eight inches long is not above 5,000. The large lobster just mentioned, on account of the incumbrance of its eggs, was unable to fold its 'tail,' which suggests the explanation of the rudimentary condition of the first pair of swimmerets. If these appendages were of the average size the large number of eggs which would naturally adhere to them would make folding of the abdomen impossible, and it is by folding the 'tail' that the egg-bearing lobster so successfully protects her eggs and eludes her enemies.

Period of Incubation.—Summer eggs which are laid in July and August are ordinarily hatched in June, after a period of from ten to eleven months. Nothing is known about the hatching of fall and winter eggs. The majority of the eggs which are hatched at Wood's Holl complete their development in June.

That young are hatched at other times is certain, and we should expect this to be the case from the variations which occur in the time of ovulation. Captain Chester in 1885 hatched some eggs at Wood's Holl Station on the 8th of November and the following days, the temperature of the water varying from 54.3 to 56 degrees Fah. Some lobsters

were hatched early in February in 1889 at the hatchery of the Fish Commission Station at Gloucester, Mass. The water was very cold, and it was estimated that as many as 10,000 lobsters were hatched.

Period of Sexual Maturity. Lobsters become mature when measuring from $7\frac{1}{2}$ to 12 inches in length. Very few under 9 inches long have ever laid eggs, while but few have reached the length of $10\frac{1}{2}$ inches without having done so. The majority of female lobsters $10\frac{1}{2}$ inches long are mature. Anatomical evidence shows that the period at which lobsters become mature is a variable one, extending over several years.

Frequency of Spawning. The adult lobster is not an annual spawner, but produces eggs once in two years. This is proved by the anatomical study of the reproductive organs, and confirmed by the percentage of egg-bearing lobsters which are annually captured. In a total catch of 2,657 lobsters, December 1st to June 30th, 1893 and 1894, the sexes were very nearly equally divided, and about one-fifth of the mature females caught bore external eggs. The catch off No Man's Land in 1894 amounted to 1,518 lobsters; 93.5% were females, and 63.7% carried eggs. When these results are averaged it is found that about one-half of the females carried eggs, as would be the case if they spawned every other year. Ehrenbaum is, without doubt, mistaken in supposing that the lobster does not breed often-er than once in four years (*Der Helgolander Humer, ein Gegenstand deutscher Fischerei*. Aus der Biologischen Anstalt auf Helgoland, 1894).

Gastroliths. Gastroliths are known only in two Macroura, the lobster and crayfish, and were observed in the lobster for the first time, and recorded by Geoffroy, the Younger, in 1709. Though a differentiated part of the cuticle, they are not cast off in the molt, but are retained and dissolved in the stomach. Their structure in the lobster,

consisting of hundreds of small spicules, makes the solution of them possible in a very short time.

The gastroliths have been supposed to possess great medical properties and to perform a variety of functions, the most common and accepted belief being that they play an important part in the provision of lime for the hardening of the new shell. The small quantity of lime which they contain, however, not more than one one hundred and twenty-sixth of that of the entire shell, according to an analysis recently made by Dr. Robt. Irvine, shows that this is relatively unimportant. Fragments of lime furthermore are always at hand, and are frequently eaten by the soft lobster, shortly after ecdysis, in the adolescent stages at least. It is more likely that the gastroliths are the result of excretion of lime which is absorbed from parts of the shell to render molting possible, and that their subsequent absorption in the stomach is a matter of minor importance.

Rate of Growth.—Larvæ increase in length at each molt (stages 2 to 10) from 11 to 15.84%, or on the average about 13.5% (measurements from 66 individuals). The increase in the young at each molt agrees quite closely with that seen in the adult, where the increase per cent. in ten cases was 15.3%. Allowing an increase per cent. at each molt of 15.3—probably not excessive for young reared in the ocean—and assuming the length of the first larvæ to be 7.84 mm. we can compute approximately the length of the individual at each molt.

Length at 10th molt	28.23 mm.	
" " 15th "	57.53 "	
" " 20th "	117.24 "	
" " 25th "	258.90 "	(9.5 inches.)
" " 30th "	486.81 "	(19.1 inches.)

According to this estimate a lobster two inches long has molted 14 times; a lobster 5 inches in length, from 20 to 21 times; an adult from 10 to 11 inches long, 25 to 26

times; and a 19-inch lobster, 30 times. These estimates do not, I believe, go very far astray. We see them practically verified up to the tenth molt.

The time interval between successive molts is the next point to consider. Here the data are very imperfect. How long is the three-inch lobster in growing to be six inches long? Probably not more than two years and possibly less. This is supported by the observations of G. Brook. We therefore conclude that a ten-inch lobster is between four and five years old, with the highest degree of probability in favor of the smaller number.

FRANCIS H. HERRICK.

ADELBERT COLLEGE.

THE NEWARK SYSTEM.

IN an article in a recent number of SCIENCE* Professor C. H. Hitchcock again objects to the use of 'Newark' as a group name in geology. This article is essentially a republication of a portion of a paper by the same author, which appeared in the American Geologist in 1890† in criticism of an article of mine in the same journal,‡ in which reasons were presented for reviving the use of Newark as a name for a certain system of rocks.

I replied§ to Professor Hitchcock's objections and criticisms, and showed conclusively, as I believe, that the term referred to has precedence over all other names applied to the system in question, which do not imply correlation. In his recent article Professor Hitchcock does not so much as mention my rejoinder; but is of the opinion that the considerations presented in his earlier paper 'would have been sufficient to convince any one, looking at the subject judicially and impartially, of the inadequacy

* Vol. 1, New Series, Jan. 18, 1895, pp. 74-77.

† Vol. 5, 1890, pp. 197-202.

‡ Vol. 3, 1889, pp. 178-182.

§ Am. Geol., Vol. 7, 1891, pp. 238-241.

of the name Newark to special recognition.' On the other hand, I am of the opinion that my reply should have silenced opposition. There is, thus, a radical difference of opinion between us. There is also a question of fact involved. Has Newark priority as a group name? This is a simple historical question that almost any one can decide from the documentary evidence. In the papers described in the following foot-note* I have presented or referred to all of the evidence known to me bearing on the question.

In Professor Hitchcock's recent article there are many statements that have no relation to the matter under discussion, since they refer to usages of later date than the introduction of the term Newark. No legitimate arguments are advanced that are not in the former paper, and as these have all been answered, there is nothing left for me to do but to follow my opponent's example and republish my reply to his five-year-old criticism.

My paper in the *American Geologist* for April, 1891, reads as follows:

"IN a brief paper on the Newark system published in this journal [*Am. Geol.*] about two years since,† I proposed a revival of 'Newark' as a group name for the reddish-brown sandstones and shales and associated trap rocks of the Atlantic coast region, which had previously been quite generally referred to the Triassic and Jurassic. A long list of names was presented that had been used to designate the rocks in question; nearly all of which implied correlation with European terranes, ranging from the Silurian to the Jurassic. The advisability of adopting a name that did not indicate re-

lationship with distant formations was also pointed out. The first name on the list referred to which met this requirement was 'Newark group,' proposed by W. C. Redfield, in 1856. That this was a group name, intended to indicate the entire formation, is shown by the language used. Redfield's words are:

"I propose the latter designation [Newark group] as a convenient name for these rocks (the red sandstone extending from New Jersey to Virginia) and to those of the Connecticut valley, with which they are thoroughly identified by foot-prints and other fossils, and I would include also the contemporaneous sandstones of Virginia and North Carolina."*

As stated in my previous paper, the term 'group' has been adopted by the International Congress of Geologists in a wider sense than was implied by Redfield. I therefore suggested that 'system' should be substituted instead. Before offering the suggestion I made what I believe to have been an exhaustive examination of the literature relating to the terrane in question, and concluded that Redfield's name had precedence over all other names that had been used which did not imply correlation.

The term Newark system has recently been adopted by several geologists, in accordance with my suggestion, and up to the present time but one voice has been raised against it. In an article on 'The use of the terms Laurentian and Newark in geological treatises,' published in this journal, † Prof. C. H. Hitchcock has formulated five objections to its acceptance. These will be considered in the order in which they were presented.

First. It is claimed that 'An essential feature of a name derived from a geograph-

* The Newark System, *Am. Geol.*, Vol. 3, 1889, pp. 178-182.

Has 'Newark' priority as a group name, *Am. Geol.*, Vol. 7, 1891, pp. 238-241.

The Newark System, *U. S. Geol. Surv.*, Bull. No. 85 (Correlation Papers) 1892.

† Vol. 3, 1889, pp. 178-182.

† *Am. Geol.* 5, April, 1889, p. 251.

* *Am. Jour. Sci.*, 2d ser. 1856, Vol. 22, p. 357; also in *Am. Assoc. Adv. Sci.*, Proc., Vol. 10, Albany meeting, 1856, p. 181.

† Vol. 5, 1890, pp. 197-202.

ical locality is that the terrane should be exhibited there in its entirety or maximum development; and that the territory about Newark, N. J., does not meet these requirements for the Newark system.

Without dissenting from the wisdom of the rule proposed, although a large number of exceptions could be found to it in the best geological memoirs, I wish to state from my own knowledge that the region about Newark may be taken as typical of the terrane named after that city. The characteristic reddish-brown sandstones and shales are there well exposed, and in the neighboring Newark mountains the associated trap rock occurs in sheets of great thickness. This statement is sustained by Prof. Hitchcock's own words, a little farther on in the paper cited, where he says, "the New Jersey terrane possesses the distinguishing features of the Trias quite as well as the one in New England."

That *Passaic* would have been a better name, as Prof. Hitchcock suggests, is perhaps true, but the one before us was definitely selected and has priority.

Second. It is stated by Prof. Hitchcock that the name 'Connecticut or Connecticut River sandstone has priority over Newark,' and was used by several geologists before Redfield's proposal in 1856, 'though none of them had proposed it as a geological term.' The admitted fact that no one had used the name referred to as a geological term, relieves me of the necessity of showing that Redfield's name has priority.

In the writings of the older geologists among whom Prof. Edward Hitchcock will always take the first rank as an investigator of the sandstones of the Connecticut valley, the terms 'Connecticut sandstone,' or 'Connecticut River sandstone,' were used in the same sense as the coördinate term I have just employed, *i. e.*, as a geographical designation; just as they might have referred to the granite of Massachusetts without any

intention of proposing a group name. The fact that the older geologists, and among them Prof. Edward Hitchcock, spoke of the Newark rocks of New England under definite group names, implying correlation, is sufficient evidence that they did not recognize the value of an independent name.

Third. It is stated that Prof. J. D. Dana adopted the name proposed by Redfield, in his lectures, but did not use it in his subsequent writings. Prof. Dana's reasons for this course have never been published, and so far as it is a precedent—happily precedents have less weight in geology than in some other professions—it indicates that we should first use the name Newark and then abandon it for other names implying indefinite correlation with distant terranes.

Fourth and Fifth. While it is admitted that the terrane under discussion is quite as well represented in New Jersey as in the Connecticut valley, it is claimed that the latter having been studied first, should have furnished the group name. I fully agree with Prof. Hitchcock in this, and could add several other group names which to my taste might be improved, but the author of a geological name, like the palæontologist who describes a new fossil, is entitled to priority. To attempt to introduce a new name for a group of rocks already sufficiently well designated, would only bring confusion, similar to that produced by the great variety of names implying correlation that have already been used for the Newark system." ISRAEL C. RUSSELL.

UNIVERSITY OF MICHIGAN.

DEATH OF GEORGE N. LAWRENCE.

THE veteran ornithologist, George N. Lawrence, died at his home in New York City, Jan. 17, 1895, at the age of 89 years. He was born in New York, Oct. 20, 1806. His wife, to whom he had been married more than sixty years, died only five days earlier.

Mr. Lawrence was one of the most careful and prolific of American ornithologists. The list of his published writings* contains 121 titles, the earliest of which appeared in 1844, the latest in 1891. The period of his productive activity thus covered nearly half a century. He was an active contemporary of all American ornithologists from Audubon and Nuttall to the younger writers of the present day. 'Baird, Cassin and Lawrence' are classic names in ornithology—names associated in joint authorship in Baird's great work on the birds of North America, published in 1858. For nearly fifty years Baird and Lawrence, then the foremost authorities on American birds, were warm personal friends, and on more than one occasion accomplished, by hearty coöperation, what neither could have done alone. It should not be forgotten that their arduous labors paved the way for the refinement of detail that characterizes the bird work of to-day.

Baird busied himself chiefly with the birds of the United States, Lawrence chiefly with those of tropical America. Lawrence described more than 300 new species from the West Indies, Mexico, Central and South America. One genus and twenty species were named in his honor—tokens of respect and esteem—by American and European naturalists.

Baird and Lawrence lived under widely different conditions. Baird led an active official life, burdened with the cares and responsibilities of three great institutions, two of which, the National Museum and Fish Commission, were his own creation; he was constantly overworked and died prematurely at the age of sixty-five years. Lawrence led a quiet, retiring life, far away from the public eye, and died at the ripe age of fourscore years and nine. Still, the

two had many traits in common; both were plain and unassuming, kind and thoughtful in their family relations, and ever ready to extend a helping hand to those, however young, whose tastes led them to the study of birds. In looking back over the twenty-five years that have passed since I first enjoyed their acquaintance, my mind constantly recurs to the kindly words of encouragement and advice that shaped my early course as a naturalist, and the friendships that followed will always live among my most cherished memories.

C. HART MERRIAM.

SCIENTIFIC LITERATURE.

A Treatise on Hydrostatics. By ALFRED GEORGE GREENHILL, Professor of Mathematics in the Artillery College, Woolwich. Macmillan & Co., London and New York. 16mo, pp. viii+536.

The science of hydrostatics, originating with Archimedes, is now more than twenty centuries old. It is, in many respects, one of the most perfect and satisfactory of the sciences. This fact, however, arises from the simplicity of the phenomena with which hydrostatics has to deal rather than from anything like continuity of progress during its lengthy history. Indeed, as regards purely hydrostatical principles, we are not very greatly in advance of Archimedes. Our superiority over him is due, first, to an immensely enlarged capacity, through the developments of mathematics, for the application of those principles; and, secondly, to the exploration of the much larger and more interesting domain of hydrodynamics, of which, in fact, hydrostatics is only a special case.

The work of Professor Greenhill treats hydrostatics from the modern point of view. He does not hesitate to cross the border for an excursion into hydrokinetics whenever desirable or essential, although some might

* The Published Writings of George Newbold Lawrence, by L. S. Foster. Bull. U. S. National Museum, No. 40. 1892.

infer from the title of the book that such excursions are avoided. The scope and character of the work may be best inferred from the following paragraphs of the preface:

"The aim of the present Treatise on Hydrostatics is to develop the subject from the outset by means of illustrations of existing problems, chosen in general on as large a scale as possible, and carried out to their numerical results; in this way it is hoped that the student will acquire a real working knowledge of the subject, while at the same time the book will prove useful to the practical engineer."

"In accordance with modern ideas of mathematical instruction, a free use is made of the symbols and operations of the Calculus, where the treatment requires it, although an alternative demonstration by elementary methods is occasionally submitted; because, as has well been said, "it is easier to learn the differential calculus than to follow a demonstration which attempts to avoid its use."

Too much stress cannot be laid on this remark with regard to the rôle of the calculus in applied science. We are coming now, after two centuries, to realize clearly that the use of the calculus has become general in all higher investigations, not because the pure mathematicians have so desired, but because the phenomena of nature demand for their interpretation such an instrument of research.

The book is a mine of interesting and useful information, and must become one of the standards for students, teachers and engineers. The principles are illustrated by a wide variety of good examples, many of which are drawn from practical applications. Special attention is given to the problems of flotation and stability of ships, and to problems arising in naval architecture. The theory of the various hydrostatic instruments, including the hydrometer, the barometer and the gas thermometer, is

worked out quite fully. A chapter is devoted to pneumatics, and another to pneumatic machines. There are also chapters on capillarity, hydraulics, the general equations of equilibrium, and on the mechanical theory of heat. In short, the work is a very comprehensive one. Few books contain more information per page, and few abound to such an extent in historical references.

The exposition of the author is in general clear and logical, though occasionally an important principle is announced without due warning. Thus, Bernoulli's theorem appears without demonstration on p. 467 in the chapter on hydraulics. It would have been more in accord with the admirable spirit of the book, we think, if the author had given in that chapter the general equations of fluid motion, and thence deduced Bernoulli's theorem, even if this enlargement had required a change in the title of the work.

Some obscurity arises here and there from the author's habit of condensation. Thus, on p. 458 we read, "so that the attraction of pure gravitation on a plummet weighing Wg is WG dynes, where G denotes the acceleration of gravity." Of course, the expert would quickly see that Wg means W grammes, but the average engineer will not commend such economy.

The book has a good, but not quite good enough, index. For example, the unusual words *barad* and *spoud* are occasionally used by the author. Their meaning is plain from the context, in most cases, to the specialist, but the general reader would not get any light on these terms from the index; for it does not contain the word *spoud*, while it refers for *barad* to a page on which this word does not occur.

These faults, however, are small ones, and such, moreover, as are well-nigh inseparable from the first edition of a book so full of sound knowledge as this one.

R. S. WOODWARD.

Eine Discussion der Kräfte der chemischen Dynamik. 3 Vorträge von Dr. Ludwig Stettenheimer. H. BECHHOLD. Frankfurt, 1895. 6 Marks.

This pamphlet of 85 pages is certainly revolutionary in character, as the author proposes to abandon some of our fundamental conceptions of chemistry, and to deal with the subject purely mechanically. Chemistry, according to the author, is the mechanics of the smallest bodies, as Astronomy is the mechanics of the largest, while Physics is a connecting link between the two.

In chemistry we have to deal with matter, with equilibria, and with forces. In chemical reactions energy is set free, and we know in many cases its mechanical expression in calories. All the groupings and unions which we express in our chemical formulæ do not necessarily have their counterpart in the substances themselves, but are only conditions of equilibrium, not general but special cases of equilibria. The molecule ceases to be a fundamental conception. Chemistry of to-day is a molecular chemistry, but we must now give up this conception, and, in the place of the molecular or chemical compound, we must introduce, as in astronomy, a 'system,' a 'chemical system.' Atoms combine to form groups due to the action of the various forces, but why not have these groups go on combining until we have something which can be perceived by the senses? If the same force of attraction which binds the atoms together also causes the groups to unite, what conditions the limits of the molecule? In a substance like potassium oxide we do not know whether two or several molecules are combined, but why may not hundreds, thousands or all the molecules be combined? This does not conflict with Boyle's law, since we may regard a gas as if it were only one molecule and having no inter-molecular spaces.

A system composed of a few well-defined atoms and groups is termed a molecular

system. These combined systems, and not the ordinary molecules, represent conditions of equilibria. In the second chapter considerable space is given to the consideration of equilibria, both stable and unstable, and the third and last is devoted to the conditions of union in the solid, liquid and gaseous states. As a result of these considerations, the author concludes that chemical forces differ in no wise from mechanical, but that everything points to a mechanical interaction between the smallest particles of matter.

While scientists are always ready to consider new ideas which will lead to wider generalizations, yet it is always a fair question to ask whether a given suggestion will accomplish this. In the present case it seems quite proper to consider whether all the chemical evidence of the existence of atoms and groups forming definite units, called molecules, has been taken into account. If so, then will this method of regarding chemical phenomena enable us to advance further or faster than that involving atoms and molecules? It can be safely predicted that chemists will be somewhat adverse to giving up conceptions upon which their whole science is built, at least until something more than abstract ideas are offered in their place, something about which they can think definitely and clearly, and which will suggest new lines of work. It is doubtful whether the work published by Dr. Stettenheimer will meet with pronounced success in removing these conceptions of atoms and molecules from chemistry, since they have proved so fruitful in the past, and seem to meet the demands of most of the working chemists of to-day.

The book, while clearly printed, contains a remarkably large number of typographical errors. Nearly a full page of corrections is given, yet the reader will encounter many mistakes in the text which form no part of

this tabulated evidence of careless proof-reading.

The reviewer has found it difficult to give a satisfactory account of the contents of the second and third chapters in a short review, so that those who may wish to follow the author's applications of his fundamental ideas must read the original.

H. C. JONES.

JOHNS HOPKINS UNIVERSITY.

Text-book of Organic Chemistry. By A. BERNTHSEN. 2d English Edition, translated by G. MCGOWAN, from the 4th German Edition. London, Blackie & Son. New York, D. Van Nostrand. 1894.

The general excellence of this work is indicated by its reception both in German and in English speaking countries. Four German editions in six years have been found necessary, and the second English edition will probably be even more extensively used than the first. The present book is a work of about 575 pages, fifty more than the previous edition, and occupies a position between the elementary and the encyclopedic text-book. As stated in the preface, the descriptive part is condensed as far as possible, and special emphasis put upon summarizing the characteristics of each class of compounds. There are frequent valuable tables of the principal properties of important classes of compounds. The subject-matter is treated in a way showing the intimate knowledge of the literature to be expected from a chemist like Bernthsen, though it seems strange that he makes no reference to American periodicals, but seems content to use the often imperfect abstracts in the foreign journals. The fourth German edition was published in 1893, and the subject is well brought to that date. A point would have been gained, and the value of the book greatly enhanced, had the translator brought to the date of publication of the English editions at least those chapters

which treat of classes of compounds on which important work was done in 1893 and 1894. I refer particularly to the sugars, terpene, etc. The translation is good, though sometimes too literal. Many German expressions have crept in, and do not make the matter any clearer. In the text, formulæ of substances are frequently used instead of names. It would be better to use names only, but if P_2S_5 is used in one place because it occupies less space than Phosphorus Pentasulphide, it should be used always, and the one should not appear on one page, and the other a few pages further on. On the whole the work is well adapted to the needs of those American colleges in which organic chemistry can receive the time and attention it deserves. With it a mature student can easily get a good working knowledge of the subject. For undergraduate work, as carried on in most of our colleges, a less ambitious course, thoroughly given and embodying the use of a smaller text-book, seems desirable.

FELIX LENGFELD.

UNIVERSITY OF CHICAGO.

Systematische Phylogenie der Protisten und Pflanzen. ERNST HAECKEL. Jena, 1894, Pp. 400.

Prof. Ernst Haeckel, of Jena, has recently begun an extensive work on the systematic evolution of animal and plant life. It is to be in three parts, the first of which has just appeared as the '*Phylogeny of the Protista and the Plants.*' The second part, on the phylogeny of invertebrates, and the third part, on that of vertebrates, are also promised during the present year. In the present volume the author outlines his plan and presents in the opening paragraphs the main data upon which his phylogenetic trees are based, namely, the three branches of natural science, palæontology, ontogeny, or the life history of individuals, and morphology. The work as a whole is in

Haeckel's most attractive popular style, and is divided and subdivided into titles and headings, thus making it delightful for reading and reference.

The first organisms, he imagines, were Monera, or '*Probionten*,' which were small homogeneous plasma particles with no anatomical structure. Life activity here was limited to mere assimilation and growth, and where the latter exceeded a certain limit of cohesion of the constituent plasma the organism split into two parts and thus formed two organisms. This was the beginning of reproduction and of inheritance. The homogeneous protoplasm of these Monera was an albuminate arising from a mixture of water, carbonic acid and ammonia. The origin of life, therefore, is little more than this particular combination of inorganic parts at a certain period. While it is probable that the Monera were widely created at this period, the atmosphere, temperature, etc., being in the proper condition, it is not probable that they have been produced spontaneously since then. Haeckel states the stages in this creation as follows: 1st. Nitro-carbon compounds were formed by the synthesis and reduction of various acids and salts. The composition was about the same as that of albumen. 2nd. The albumen molecules with water formed crystalline, but as yet microscopically invisible, molecules. 3rd. These albumen groups arranged themselves in definite ways and formed microscopically visible plasma granules. 4th. These plasma granules had the power to assimilate food, a chemical change, and to grow, and at the limit of cohesion to divide and form new ones. These homogeneous plasma granules were *Monera*.

All of this, however, is hardly new to the readers of Haeckel. The greatest novelty of this work lies in his radical views as to the re-classification of animals and plants. He first separates them on the old lines according to their mode of nutrition. Plants are

essentially formative organisms and have the power by the thermal energy derived from the sun's rays to change inorganic into organic combinations, taking up carbon dioxide and throwing off oxygen. Animals, on the other hand, are just the reverse; with them the chemical energy of combinations is reduced to heat and motion. It follows that plants must have been the first forms of organisms on the earth, because they only are able to transform by the energy of the sun's rays inorganic substances into organic. Animals were developed secondarily from the plants by a process of parasitism. That is, some of the plants began to absorb and assimilate parts of other plants, thus changing from an inorganic, carbon-dioxide diet to an organic mode of nutrition. This process of nutrition-change, known as *metasitism* (*metasitismus*), is familiar in certain of the higher plants which have acquired the power to absorb solid nutriment, for example, the insectivorous plants. Haeckel derived the original name then from the original plant by a mere change in nutrition. Metasitism plays a most important part in the new theory, and in this book is given more importance than it has hitherto received.

From this original homogeneous substance the several parts of the cell, as it is known to-day, were derived by a process of differentiation. Certain parts of the plasma, by reason of their position, became adapted for the acquisition of food, while the internal parts, unable to take in food, gradually assumed reproductive functions, and in time came to have a certain definite form; thus arose the cell nucleus. The outer portion of the cytoplasm, in addition to its nutritive function, gradually acquired a protective function also, and membranes were differentiated. Later, by a process of incomplete cell division, colonies of these simple cells were formed, and from these the higher cell aggregates were derived by a process

of division of labor. Haeckel supposes, from the almost universal appearance of nuclei in cells, that this differentiation, into nucleus and cytoplasm, must have taken place at a comparatively early period, and that all of the forms of life which have a nucleus must have been derived from one early nucleated type, for he is a firm believer in the inheritance of acquired characters.

The primitive plants, from which all of the organic world has been derived, are called 'Probiontes' or archephyta. From this primitive stem, which was non-nucleated type, and composed of absolutely homogeneous protoplasm without indications even of the 'micellæ,' of Hertwig, or the 'Schaumplasma,' of Butschli, were given off the primitive nucleated plant types of the Flagellata in one direction, and the primitive non-nucleated animal (Moneran) types in another. In addition to these two derivatives, there was a third, which represents the original chlorophyll bearing plant. These were the *Cyanophyceæ* or *Chromaceæ*, in which the chlorophyll is not in the form of small plates, but exists as a diffuse coloring matter within the cell. From these forms, which also were non-nucleated, the Bacteria arose by a process of metasitism.

In the primitive plant types of Flagellata the nuclei have not acquired a distinct differentiation, but remain absolutely homogeneous (*i. e.*, not divisible into nuclein, paranuclein, etc.), and therefore represent the first and most primitive forms of nuclear differentiation. These are not derived from the Monera or non-nucleated animal types, but come directly from the primitive plant type or the Archephyta. He gives the name Mastigota to these early flagellated plant cells which belong to the class of Palmellaceæ, and from them he derives all of the higher plants and animals, the latter arising polyphyletically by the process of metasitism. The rise of the higher animals and of man is traced in a direct line down to

these primitive plants. The first step in the scale is the origin of the animal Flagellates by change in the method of nutrition and consequent loss of chlorophyll or allied bodies. Then comes the formation of colonies and gradual division of labor until the highest type of protozoon organization is attained. This type is represented by the form *Catallacta*, which is thus the connecting link between the protozoa and metazoa. Volvox occupies a similar position in the phylogeny of the higher plants in their relations to the protophyta.

In general it may be said that this part of the 'Systematische Phylogenie' is a revision of the earlier views of Haeckel. The one essentially new feature is the division line which he makes between plants and animals. This border line has been the subject of contention between zoölogists and botanists for ages, and now he proposes to form a hard and fast distinction. The dividing line is the ability of the organisms, whatever they may be, to form chlorophyll or similar bodies, and thus to derive nourishment, in conjunction with solar energy, from inorganic substances. This, as may readily be supposed, makes havoc with our existing classifications, and the changes will be accepted, if ever, only after much contention. For example, the Fungi (*Chytridiaceæ*, *Zygomycetes* and *Ovomycetes*) are taken from the vegetable kingdom and transferred to the animal, and with them the *Saccharomycetes* (yeast) and the Bacteria. The latter he claims have absolutely no connection with the fungi—"Indessen beruht diese Auffassung nur auf der Macht der dogmatischen Tradition und nicht auf welchem rationellen Urtheil"—is Haeckel's forcible way of representing this position.

On the other hand, many of our so-called Protozoa are taken into the Protophyte division of plants. All forms which have coloring matter in the form of chlorophyll, and are, therefore, holophytic in their mode

of nutrition, are transferred to the vegetable kingdom. The greatest drafts are upon the group of Flagellata, which are so often provided with chromatophores. He does not take the Radiolaria, however, with their 'yellow cells,' probably for the reason that they are symbiotic forms. This will probably be the sticking point in such a classification, for even if the dividing principle be admitted, the difficulty will ever be to decide, in these low forms, what is true chlorophyl formation and what symbiosis. The discoveries of Famintzin and Entz show that in many of the lower forms the presence of chlorophyl is due to minute plant cells which live independently of the animals with which they are associated. Before the classification can be complete it must be determined for each form whether the chlorophyl is a symbiotic plant or a natural product.

GARY N. CALKINS.

GEOLOGY.

Kansas River Section of the Permo-Carboniferous and Permian Rocks of Kansas. CHARLES S. PROSSER. Bulletin Geol. Soc. America, Vol. 6, pp. 29-54. 1894.

In the above paper Professor Prosser considers the historic section of the Upper Paleozoic rocks as exposed along the upper course of the Kansas River. As is well known, the early geologists of the State engaged in a most animated controversy over the correlation of the geological formations of this region. Although the investigations of Meek, Hayden, Hawn and Swallow began more than thirty-five years ago and were vigorously conducted for a number of years, still the subject was not settled, and many of the points at issue between the disputants are still open for decision.

The author describes various typical geological sections as exposed in the steep bluffs of the Kansas river and its tributaries, giving the distinctive geological characters and fossils of the various divi-

sions. In connection with this description, there is a complete review of the previous geological work, followed by a chart of tabulated sections, on which the correlation of the early geologists is indicated.

Possibly the most interesting fact in the paper to a geologist familiar with the region, is the statement that the Cottonwood and Manhattan limestones are the same. This limestone, which is the most valuable stone in the State for construction, has been extensively used, and the author states that he has traced it across the country from Cottonwood Falls, on the Cottonwood River, to Manhattan, on the Kansas River. Another interesting fact in reference to the stratigraphical geology is the correlation of the buff, magnesian limestones near Fort Riley with those of Florence, in the Cottonwood Valley.

In conclusion, it is stated that this is only a preliminary paper and that the writer has in hand the preparation of a report in which a full description of the formations of Central Kansas will be given, with the distribution of their fossils and their general correlation.

NOTES AND NEWS.

FORESTRY AND ECONOMIC BOTANY.

THE steady increase of interest in forestry matters, so desirable and essential, has recently become evident in many ways, especially in the Eastern States. New York, Pennsylvania and New Jersey have taken long strides in the right direction in the shape of much needed legislation; and the establishment of forestry journals for the promulgation of knowledge respecting the nature and value of our native trees is a step that will receive commendation from thoughtful people everywhere. The South Jersey Woodmen's Association has shown wisdom in securing an official organ through which they may increase the scope of their influence. The first number of 'The New

'Jersey Forester' (May's Landing, New Jersey), contains valuable and interesting articles from the pens of well known scientists. The editor, Mr. John Gifford, Special Forestry Commissioner of New Jersey, reviews recent forestry legislation in that State, and discusses the causes and effects of forest fires in the southern interior of New Jersey; B. E. Fernow, Chief of the Forestry Division, Washington, D. C., presents the extent and aims of the forestry movement in the United States. An illustrated article on 'The Periodical Cicada, or Seventeen Year Locust,' by Professor John B. Smith, State Entomologist, New Brunswick, N. J., is followed by interesting contributions on 'The Evil Effects of Drifting Sands Along the Jersey Coast,' by Professor Charles S. Dolley, President of the American Association for the Advancement of Education, and on 'The Colony of Russian Refugees at Woodbine,' by H. L. Sabsovich, Superintendent of the Baron Hirsch Colony. The example set by this publication, both in its purpose and the high standard presented in this first number is one which may well be followed by State forestry associations throughout the country.

ALL teachers of botany and lovers of trees, especially those interested in forestry agitation, will welcome the excellent charts issued by Miss Lewis. The execution of the drawings of leaves and acorns in Chart No. 1 is all that could be desired, accurate and finished in every detail, as might be expected of anything coming from the pencil of one so expert, and so widely and favorably known as a thorough botanist and skilled artist. Miss Lewis, a member of the Academy of Natural Science of Philadelphia and a teacher of long experience, has done much to promote a love for natural history and to encourage its being taught in our schools, and she is to be congratulated upon her latest contribution to this good work. Teachers have only to see the charts

to insure the introduction of the same into the class-room.

STILES AND HASALL announce in a recent number of the Veterinary Magazine the discovery of a new species of intestinal fluke (*Distoma tricolor*) in the Cotton-tail rabbit (*Lepus sylvaticus*, *Bachman*) and in the Northern hare (*L. americanus Erxleben*).

A NEW and serious enemy to pear trees has recently been discovered in New Jersey by Dr. John B. Smith. It is a flat-headed borer (*Agrilus Sinnatus* Ol.), a species common in Europe, and was imported into a nursery in Union county, N. J., not more than ten years ago. It is already widespread in that State, probably occurring also in New York. The last number of 'Insect Life' (Vol. VII., No. 3) contains an illustrated article on this pest.

M. G. V. BERTHOUMIEU, in the first number of the current volume of *Annales de la Société entomologique de France*, has begun the publication of what bids fair to be a very complete monograph of the *Ichneumonidæ* of Europe.

E. A. SMYTH, JR., of the Virginia Agricultural College, has recently examined the stomach contents of a large number of hawks and owls, with the result that he is able to show that the good offices of many of these birds by far overbalance any occasional instance of ravages upon the poultry yard. The 'trim and dauntless little sparrow hawk' is found to be a very active enemy of caterpillars, grasshoppers and other insects, as well as of the ubiquitous English sparrow, and to deserve protection at the hands of all farmers.

THE Cornell University Agricultural Experiment Station Bulletins for December, 1894 (Nos. 78, 80), just issued, treat respectively of 'The Quince in Western New York,' a subject of considerable interest, inasmuch as quinces are more extensively grown in that district than anywhere else in North

America; and of 'The Variety and Leaf-Blight of the Strawberry.' The publications of the Cornell Station excel in beauty of illustration much of the material issued by similar institutions.

ENTOMOLOGY.

IN a recent and excellently illustrated memoir (Museum Dzeduszyckianum, iv-Lemberg) on the insect fauna of the petroleum beds of Boroslow, Galicia, Lemnicki describes no less than seventy-six coleoptera, of which nineteen are regarded as identical with living European insects, while the others find their nearest allies in boreal Europe, Asia and America. As only four species are identical with those found by Flach at Hösbach, Bavaria, in beds looked upon as Lower Pleistocene by Flach, and since the Hösbach coleoptera as a whole show far less boreal affinities than those of Galicia, Lemnicki thinks the Hösbach fauna must be considered Middle Pleistocene and the Galician Lower Pleistocene.

RUSSIAN SCIENCE NOTES.

THE Jubilee-book issued by the University of Kasan in commemoration of the Lobachévsky centenary has already reached a very large circulation. His compatriots are pushing the non-Euclidean geometry.

N. P. Sokolov has just issued at Kiev (University Press) a pamphlet of 32 pages (large 8vo) entitled 'The significance of the researches of N. I. Lobachévsky in geometry.'

Volume VI. of the second series of the Bulletin of the physico-mathematical society of Kasan, pp. 18-41, contains an interesting contribution by W. Sichstel on the fundamental theorems of spherical geometry.

Two books on America have lately been published in Russia. One is by Witkowsky, a scientist sent by the Russian government to study geodetic work in the United States. The other is published by a Russian, now

resident in Los Angeles, who has been more than ten years in America, and has here amassed a fortune. He is a fervid republican, and writes under the *nom-de-plume* Tverski.

The well-known and justly admired writer Korolenko, ranked by the Russians second only to Tolstoi of living authors, was during 1893 in America, and is about to issue his impressions of travel. This book, because of the high reputation of the author, is awaited with keen interest.

GEORGE BRUCE HALSTED.

THE COLD SPRING HARBOR LABORATORY.

THE A. A. A. S., at its Brooklyn meeting, made two appropriations to aid research in biological laboratories. One at Wood's Holl, of which notice was given in our last number, and one at the Cold Spring Harbor Laboratory; concerning which the following is the wording of the vote:

"That \$100 be granted to Franklin W. Hooper in behalf of the Biological Laboratory at Cold Spring Harbor, to be devoted to defraying the expense of original research; the nature of this to be approved by a committee selected by the Council."

The committee appointed consists of the Vice-Presidents-elect of Section F. and G., viz.: Prof. D. S. Jordan and Prof. J. S. Arthur.

Applications are to be sent to Prof. F. W. Hooper, Brooklyn Institute of Arts and Sciences, or to Prof. H. W. Conn, Wesleyan University, Middletown, Conn.

WASHINGTON LECTURES.

THE Series of Saturday Lectures, complimentary to the citizens of Washington, will be continued during the season of 1895, under the joint auspices of the Anthropological and Geological Societies. Two courses have been provided for, each so arranged as to give a logical introduction to the science treated.

The addresses will be delivered in the Lecture Hall of U. S. National Museum, 4:20 to 5:30 P. M., on the dates specified. Citizens of Washington and their friends are cordially invited to attend.

The anthropologic course will comprise: (1) an exposition of the elements of anthropology by the President of the Anthropological Society, and (2) somewhat more detailed expositions of the different branches of the science of man by representatives of the four sections of the Society. The geologic course, which is provisionally arranged, will comprise an exposition of the growth of North America from the most ancient geologic period to the present time, illustrated by maps showing various stages in continental development.

ANTHROPOLOGY.

February 23.—*What is the Science of Demology?* MAJOR J. W. POWELL.

March 2.—*Human Growth*: DR. FRANZ BOAS.

March 9.—*The Founding of Sociology*: Vice-President LESTER F. WARD.

March 16.—*The Progress of the Scientific Method*: Vice-President W J McGEE.

March 23.—*The Growth of Arts*: Vice-President FRANK HAMILTON CUSHING.

GEOLOGY.

March 30.—*The Continent in Algonkian Time*: PROF. C. R. VAN HISE.

April 6.—*The Continent in Cambrian and Silurian Time*: HON. CHARLES D. WALKOTT.

April 13.—*The Continent in Devonian Time*: MARIUS R. CAMPBELL.

April 20.—*The Continent in Cretaceous and Tertiary Time*: G. K. GILBERT.

April 27.—*The Continent in Glacial and Recent Time*: PROF. WILLIAM B. CLARK.

A PROPOSED NATIONAL UNIVERSITY.

REPRESENTATIVE HAINER, of Nebraska, has introduced a bill to establish the University of America, in which each State, Ter-

ritory and Congressional District shall be entitled to an equal proportionate number of students, chosen by means of open competitive examinations. Instruction in all the branches of all departments of knowledge is to be given, and facilities furnished for scientific and literary research and investigation. The government of the University is to be vested in a board of twenty regents.—*Evening Post*.

GENERAL.

JOHN MURRAY has published the report of the Oxford meeting of the British Association edited by the Assistant Secretary, Mr. G. Griffith. In addition to the address of the President, Lord Salisbury, and those of the Vice-Presidents of the several sections, there are printed in full eight papers by special invitation of the general committee, among them Professor Langley's *On Recent Researches in the Infra Red Spectrum*. The other papers are given in abstract or by title only. Four hundred pages, half the volume, are taken up by the reports of committees and investigators, previously appointed.

DR. HERMANN WEBER, a Fellow of the College of Physicians in London, gave last December £2,500 for the purpose of founding a prize to be given triennially for the best essay on tubercular consumption. The competition is open to writers in all countries.

THE Vienna Academy of Sciences has received by the will of Josef Treitel 800,000 florins to be used for the advancement of astronomy.

PROFESSOR WELDON is announced to discuss *Variation in Animals and Plants* at the second of the special meetings of the Royal Society.

M. GUIGNARD has been elected a member of the Section of Botany of the Paris Academy of Sciences, succeeding M. de Chartre.

DR. F. N. SCHMITZ, Professor of Botany in the University of Greifswald, died on January 28, at the age of 44.

THE University of Wisconsin has begun the publication of series of bulletins in Philology and Literature, in Science, in Engineering, and in Economics, Political Science and History. The numbers so far issued are: *On the Speed of the Liberation of Iodine in Mixed Solutions of Potassium Chlorate, Potassium Iodide and Hydrochloric Acid*, by Herman Schmidt. *Track*, by L. F. Loree. *Some Practical Hints in Dynamo Design*, by Gilbert Wilkes. *The Steel Construction of Buildings*, by C. T. Purdy. *The Evolution of a Switchboard*, by Arthur Vaughan Abbott. *The Geographical Distribution of the Vote of the Thirteen States on the Federal Constitution, 1787-8*, by Orin Grant Libby.

THE J. B. LIPPINCOTT CO. announce *Suggestions to Hospital and Asylum Visitors*, by Dr. John S. Billings and Dr. Henry M. Hurd, and *A Text-book of Chemistry*, intended for the use of pharmaceutical and medical students, by Professors Samuel P. Sadtler and Henry Trimble, of the Philadelphia College of Pharmacy.

GINN & Co. announce *The Religions of India*, by Edward Washburn Hopkins.

D. APPLETON & Co. announce *The Story of the Stars*, by G. F. Chambers, as the first volume in a new series of 'Useful Stories.' This series includes *The Story of the Earth*, by H. G. Seeley; *The Story of the Primitive Man*, by Edward Clodd; *The Story of the Solar System*, by G. F. Chambers. The same publishers announce a translation of Max Nordau's *Entartung*.

SOCIETIES AND ACADEMIES.

THE NEW YORK ACADEMY OF SCIENCES.

THE Section of Geology and Mineralogy, on February 18, listened to papers of which the following are abstracts: Heinrich Ries

described the geology and petrography of the 'Harrison Granite' of Westchester county, N. Y. This forms an elongated belt, principally in the town of Harrison, on Long Island Sound, and is in the midst of the mica schists, which Dr. F. J. H. Merrill regards and has recently mapped as metamorphosed representatives of the Hudson River stage. The granite contains both hornblende and biotite and is really a granite-diorite. It is all more or less gneissic, and shades from a coarsely laminated variety with many 'Augen' of feldspar, in the central portion, to decidedly schistose varieties at the border. Evidences of crushing and many curious inclusions in the feldspar are abundant.

In discussion, J. F. Kemp cited the many intrusive bosses of granite all along the north shore of the Sound from Stony Creek, Conn., to Niantic, R. I. The results of observations as yet unpublished, on those in Rhode Island, were given and a few notes on their mineralogy.

G. F. Kunz followed with a paper on the 'Minerals used for the Assyrian, Babylonian and Sassanian Cylinders, Seals, etc.,' which was illustrated by many specimens and lantern slides. An abstract of the paper, which will be printed in full in the Transactions of the Academy, is as follows:

The seals that date from 4000 B. C. to 2500 B. C. are cylinders, a form that is thought to have been suggested by the joint of a reed. Nearly all depict animals without other ornamentation. They were made of black or green serpentine, conglomerate, diorite, and often of the central whorls of the large conchs from the Persian Gulf. From 2500 to 600 B. C. the cylindrical shape continues, but, in addition to the animals, from one to six rows of cuneiform characters appear. Various colored chalcedony, (especially a blue variety), brick red ferruginous quartz and red hematite are also used. Up to this time the carving was

done with a sapphire point, but in the fifth century wheel-work begins to appear. In the sixth century B. C. cylinders begin to be partially replaced by cone-shaped seals, and by the scaraboid forms introduced from Egypt. From the third century B. C. to the third century A. D. the seals become lower and flatter, and finally graduate into rings, mostly with Persian or Sassanian characters. Although in part made from the stones of the neighboring hills, yet rarer materials begin to appear—evidently obtained by trade with Egypt and other countries more or less remote.

In addition to the minerals mentioned above, the following are recognized: clear, pellucid quartz, amethyst, agates of various colors, lapis-lazuli from Bodakshan in Turkestan, amazon-stone, possibly of Egyptian origin, calcite, green and white and in the form of various marbles, aragonite, gypsum, syenite and jade.

It is hoped that further study may enable us to trace these minerals to their original localities with greater certainty.

J. F. KEMP, *Recording Secretary.*

SCIENTIFIC JOURNALS.

THE JOURNAL OF THE AMERICAN CHEMICAL SOCIETY, MARCH.

The Synthetic Food of the Future: HARVEY W. WILEY.

The Determination of Phosphoric Acid: H. PEMBERTON, JR.

On the Estimation of Sulphur in Pyrites: G. LUNGE.

Improvement in the Manufacture of Acetone: E. R. SQUIBB.

Report of Committee on Atomic Weights, Published During 1894: F. W. CLARK.

Coloring Matter in the California Red Wines: W. D. BIGELOW.

The Penetration Machine—An Explanation: H. C. BOWEN.

Notes: Argon.

AMERICAN JOURNAL OF PSYCHOLOGY, JAN.

Comparative Observations on the Indirect Color Range of Children, Adults, and Adults Trained in Color: GEO. W. A. LUCKEY.

Minor Studies from the Psychological Laboratory of Cornell University: Taste Dreams: E. B. TITCHENER. *On the Quantitative Determination of an Optical Illusion:* R. WATANABE, PH. D. *The Cutaneous Estimation of Open and Filled Space:* C. S. PARRISH.

The Daily Life of a Protozoan; A Study in Comparative Psycho-physiology: C. F. HODGE, PH. D., and H. AUSTIN AIKINS, PH. D.

Minor Studies from the Psychological Laboratory of Clark University: A Study of Individual Psychology: CAROLINE MILES. *The Memory After-Image and Attention:* ARTHUR H. DANIELS, PH. D. *On the Least Observable Interval between Stimuli addressed to Disparate Senses and to Different Organs of the Same Sense:* ALICE J. HAMLIN. *Notes on New Apparatus:* EDMUND C. SANFORD.

On the Words for 'Anger' in Certain Languages; A Study in Linguistic Psychology: A. F. CHAMBERLAIN, PH. D.

A Laboratory Course in Physiological Psychology; The Visual Perception of Space: EDMUND C. SANFORD.

Proceedings of the Third Annual Meeting of the American Psychological Association at Princeton.

Psychological Literature.

NEW BOOKS.

History of Chemistry. F. P. VENABLE. Boston, D. C. Heath & Co. 1894. Pp. viii + 157.

Mental Development of the Child and the Race. Methods and Processes. JAMES MARK BALDWIN. New York and London, Macmillan & Co. 1895. Pp. xvi + 496. \$2.60.

Qualitative Chemical Analysis of Inorganic Substances as Practiced in Georgetown College, D. C. New York, Cincinnati, Chicago, American Book Company. 1894. Pp. 61.